

What is claimed is:

1. A catheter comprising:
  - an elongate catheter body,
  - a cooling chamber defined within the catheter body,
  - an expandable member disposed around the cooling chamber.
2. The catheter of claim 1, wherein the expandable member envelops the cooling chamber.
3. The catheter of claim 1, wherein the expandable member is disposed around the cooling chamber to define an interstitial space therebetween.
4. The catheter of claim 3, wherein the interstitial space is in fluid communication with a source of fluid evacuation.
5. The catheter of claim 3, wherein the cooling chamber is a first expandable membrane inflatable from a first state to a second state.
6. The catheter of claim 5, wherein the catheter body further comprises a coolant injection tube in fluid communication with:
  - (i) a source of coolant, and
  - (ii) the cooling chamber,and wherein the cooling chamber is inflatable by the flow of coolant from the injection tube into the first expandable membrane.

1 7. The catheter of claim 6, wherein the catheter body further comprises a  
2 primary coolant return lumen in fluid communication with:

3 (i) a source of fluid evacuation, and

4 (ii) <sup>B</sup> the cooling chamber,

5 and wherein the coolant injection tube, the cooling chamber, and the primary  
6 coolant return lumen define a first fluid pathway for the flow of coolant.

Sum  
B' 1 8. The catheter of claim 7, wherein the catheter body further comprises a  
2 secondary coolant return lumen in fluid communication with:

3 (i) a source of fluid evacuation, and

4 (ii) the interstitial space,

5 and wherein the interstitial space and the secondary coolant return lumen define a  
6 second fluid pathway for the flow of coolant.

1 9. The catheter of claim 3, wherein the cooling chamber has an outer surface  
2 and the expandable member has an inner surface, said surfaces being substantially  
3 in apposition to one another to define a first volume of the interstitial space.

3 2  
1 10. The catheter of claim <sup>2</sup>9, wherein at least one of  
2 (i) the inner surface of the expandable member, and  
3 (ii) the outer surface of the cooling chamber,  
4 is topographically non-uniform.

4  
11. The catheter of claim ~~10~~<sup>3</sup>, wherein at least one of  
(i) the inner surface of the expandable member, and  
(ii) the outer surface of the cooling chamber,  
is patterned to enhance the flow capacity of fluid flow in the interstitial space.

5  
12. The catheter of claim ~~10~~<sup>3</sup>, wherein at least one of  
(i) the inner surface of the expandable member, and  
(ii) the outer surface of the cooling chamber,  
is in part formed using plasma treatment.

6  
13. The catheter of claim ~~10~~<sup>3</sup>, wherein at least one of  
(i) the inner surface of the expandable member, and  
(ii) the outer surface of the cooling chamber,  
is in part formed using vapor deposition of additional material onto said surface.

7  
14. The catheter of claim ~~10~~<sup>3</sup>, wherein at least one of  
(i) the inner surface of the expandable member, and  
(ii) the outer surface of the cooling chamber,  
is in part comprised of a plurality of partially raised surfaces arranged on said  
surface.

8  
15. The catheter of claim ~~8~~<sup>1</sup>, further comprising a plurality of small particles  
disposed in the interstitial space.

Sub  
B2  
16. The catheter of claim 3, further comprising a flexible structure disposed  
within the interstitial space and around the cooling chamber.



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~~22~~

1 A catheter comprising:  
2 a handle in fluid communication with  
3 a supply of cooling fluid having a boiling temperature, and  
4 a source of fluid evacuation,  
5 a cooling chamber having fluid impermeable inner and outer surfaces,  
6 an elongate catheter body having  
7 a coolant injection lumen having proximal and distal end portions,  
8 the proximal end portion being in fluid communication with the supply of cooling  
9 fluid, the distal end portion being in fluid communication with the cooling  
10 chamber, and  
11 a primary return lumen having proximal and distal end portions, the  
12 proximal end portion being in fluid communication with the source of vacuum, the  
13 distal end portion being in fluid communication with the cooling chamber,  
14 an expandable member having inner and outer surfaces coupled around said  
15 cooling chamber, wherein a space exists between the cooling chamber outer  
16 surface and the expandable member inner surface, and  
17 a secondary return lumen disposed within the catheter body, having  
18 proximal and distal end portions, the proximal end portion being in fluid  
19 communication with the source of vacuum, the distal end portion being in fluid  
20 communication with the space.

14  
~~23~~

1 The catheter of claim ~~22~~<sup>15</sup>, wherein the cooling chamber is controllably filled  
2 with cooling fluid, and vacuum is applied to the primary return lumen to direct the  
3 cooling fluid to flow from the cooling chamber through to the primary return  
4 lumen.

